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MATHEMATICS IN NATURE

The object of the research includes exponential, logarithmic and trigonometric functions. The subject of the research is their application in natural environment and technology. The aim of the research is to show the concept of function in the process of development, the usefulness of studying the functions mentioned and to prove the relationship of mathematical and biological phenomena and processes.

The logarithmic spiral

The logarithmic spiral is the only type of spiral, which does not change its shape with size increasing. This property explains why the logarithmic spiral is so often found in nature. [Living?] Organisms usually grow, saving the general outline of their shapes. Organisms often grow in all directions. Adult organisms are higher and thicker than small ones. But shells of marine animals can grow only in one direction. Creatures which do not stretch too long have to curl up and each next turn is similar to the previous one. For example, when mollusk Nautilus increases in size, his body curls up into a logarithmic spiral. However, his shell does not change its shape: if we look under the microscope at the centre of the shell, we will see exactly the same spiral that would be obtained if the shell grew up to the size of the galaxy. Outlines shaped by a logarithmic spiral are peculiar to many mollusks and snails shells, but also to horns of some mammals such as wild sheep. It can be said that the spiral is a mathematical symbol of types of growth correlation. The great German poet Johann Wolfgang von Goethe believed that the logarithmic spiral is a mathematical symbol of life and spiritual development [1].

Stars, noise and logarithms

This subtitle joins things that seem to be unjoinable. Noise and stars are united here because the power of noise and brightness of stars are measured in the same way – on a logarithmic scale. Galaxy which owns the solar system is curled as a logarithmic spiral. Astronomers divide stars in the visible and absolute magnitudes: stars of the first magnitude, second, third and so on. The sequence of the apparent magnitudes perceived visually, is an arithmetic progression. But their natural brightness varies by a different law: the brightness of stars makes a geometric progression with denominator 2.5. It is easy to understand that "magnitude" of a star is a natural logarithm of brightness. In short, estimating the brightness of stars, astronomers operate the table of logarithms, compiled on the basis of 2.5.

The power of noise is evaluated similarly. Harmful affects of industrial noise on the workers health and productivity encourages the development of precise numerical estimate of the power of noise. The unit of the power is "bel" but practically power units are used, equal to its deciles – the so-called "decibels". Consequent power degree 1 bel, 2 bels and so on makes an arithmetic progression. Physical quantities characterizing noise (energy, sound intensity etc.) make a geometric progression with denominator 10. Power expressed in bels equals to decimal logarithm of the corresponding physical quantity [2].

LITERATURE

1. Виленкин Н. Я. “Функции в природе и технике”, М., “Просвещение”,М.,1978.
2. Клейнер Г. М., Клейнер Л. М. Математическая и научная картина мира. – К..: Рад. шк., 1984.